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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
WILKINS III, HARRY D	
ART UNIT	**PAPER NUMBER**
1742	22

DATE MAILED: 11/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

CLO 22

Office Action Summary	Application No.	Applicant(s)	
	09/773,782	ROWE ET AL.	
	Examiner	**Art Unit**	
	Harry D Wilkins, III	1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 26 September 2003 .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-41 is/are pending in the application.

4a) Of the above claim(s) 8-17 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-7 and 18-41 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 02 February 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

1. Claims 1-41 are pending. Claims 8-17 are withdrawn from consideration as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-7 and 18-26 and 28-41 are rejected under 35 U.S.C. 103(a) as unpatentable over Kanno et al (US 5,225,154) in view of Inagaki et al (US 4,810,461).

Kanno et al teach (see abstract) a nuclear fuel cladding with three layers, an inner zirconium metal layer, an outer Zircaloy-2 layer and an intermediate layer. Kanno et al teach (see col. 3, lines 37-40) that the intermediate layer is made of a "high ductility alloy which is higher in ductility than the outer surface layer and which is higher in strength than the inner surface layer". Kanno et al gives examples (see col. 4, lines 22-34), such as stainless steel or a copper alloy.

Kanno et al do not teach that the intermediate layer is a zirconium-based alloy with a coarse grained lath alpha microstructure.

Inagaki et al teach (see abstract) an α-zirconium-based alloy that is used as a nuclear fuel cladding. Inagaki et al teach (see abstract) that the alloy contains 1-2 wt% Sn, 0.20-0.35 wt% Fe, 0.03-0.16 wt% Ni, 0.05-0.15 wt% Cr and the balance Zr. Thus, Inagaki et al fails to meet the claimed range of Fe. However, the claimed composition

range of Fe would have been obvious to one of ordinary skill in the art because the prior art range is close enough, e.g.- 0.20 wt% vs. 0.1999 wt%, that it would have been expected to have the same properties, see MPEP 2144.05. Inagaki et al do not expressly teach that the α-phase of the zirconium is coarse-grained lath α microstructure. Inagaki et al teach (see col 5, lines 7-68) that the method of processing the zirconium alloy is quenching from a β-phase temperature (i.e.-beta heating treating followed by fast quenching), repeating the steps of cold working and annealing (i.e.-performing at least 2 steps of cold working and annealing). The annealing is conducted at 550-640°C. Inagaki et al teach (see col 9, lines 16-27) that the cold working step can be at 40% working ratio and that the final annealing occurred at a temperature above the recrystallization temperature. Inagaki et al teach (see col. 7, lines 55-67) that Fe and Ni have a detrimental effect on the neutron absorption of the alloy. In addition, Inagaki et al teach (see Table 3) that the strength and elongation characteristics of the alloy are on a par with the strength and elongation characteristics disclosed for the stainless steel and copper alloys in Kanno et al.

With respect to the property of the coarse grained lath α microstructure, the composition and method of forming the alloy taught by Inagaki et al are substantially identical to the disclosed composition and process, therefore, one of ordinary skill in the art would have expected that the products taught by the reference would have the same coarse grained lath α microstructure as claimed.

"Where the claimed and prior art products are identical or substantially identical in structure or composition or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established, In re Best 195 USPQ 430, 433 (CCPA 1977). 'When the PTO shows a sound basis for believing that the products of the applicant and the prior art are the

same, the applicant has the burden of showing they are not.' In re Spada, 15 USPQ2d 1655, 168 (Fed. Cir. 1990). Therefore, the prima facie case can be rebutted by evidence showing that the prior art products do not necessarily possess the characteristics of the claimed product. In re Best 195 USPQ 430, 433 (CCPA 1977)." See MPEP 2112.01.

Therefore, it would have been obvious to one of ordinary skill in the art to have made the nuclear fuel cladding of Kanno et al using the α-Zr-alloy of Inagaki et al as the middle layer because Inagaki et al teach (see col. 3, lines 56-58, col. 8, lines 16-19 and Table 3) that the alloy possessed adequate strength and ductility to satisfy the requirements of the intermediate layer of Kanno et al and the alloy of Inagaki et al provides (see col. 7, lines 55-67) lower neutron absorption than the stainless steel (Fe-alloy) or Cu-alloy of Kanno et al which is highly advantageous for a nuclear fuel rod cladding.

Regarding claims 2, 3, 18, 19, 31 and 32, Inagaki et al teach (see col 4, lines 42-54) that the alloy contains small second phase precipitates, specifically Sn_2Ni_3. The size of the particles is less than 0.2 μm.

Regarding claims 4, 5 and 34, because the process taught by Inagaki et al is substantially identical to the method employed in the present invention, one of ordinary skill in the art would have expected the zirconium alloy of Inagaki et al to possess a less than 50% partially recrystallized microstructure as claimed.

Regarding claims 6, 7 and 35, because the process taught by Inagaki et al is substantially identical to the method employed in the present invention, one of ordinary skill in the art would have expected the zirconium alloy of Inagaki et al to possess an acicular structure which includes a lath spacing within the range of 0.5-3.0 μm as claimed.

Regarding claims 20 and 33, because the process taught by Inagaki et al is substantially identical to the method employed in the present invention, one of ordinary skill in the art would have expected the zirconium alloy of Inagaki et al to possess second phase precipitates which include at least one of Fe and Cr as claimed.

Regarding claims 21 and 30, see above regarding claim 1, particularly the processing steps for claim 30.

Regarding claim 22, the method of treatment disclosed by Inagaki et al above is identical to the claimed method except for the inclusion of additional steps at the end. However, the present claim recites a method "comprising" a list of steps. This language is read to be open to the inclusion of additional processing steps.

Regarding claims 23 and 24, Inagaki et al teach (see col 9, lines 16-27) that the cold working step can be at 40% working ratio. This value is about 36%.

Regarding claim 25, Inagaki et al teach (see col 9, lines 16-27) that the beta heat treating occurs at 1000°C.

Regarding claim 28, Inagaki et al teach (see col 5, lines 57-59) that the preferred temperature for the annealing is 550-640°C.

Regarding claim 26, Inagaki et al do not teach that the beta heat treatment occurs for a duration of 1 to 10 seconds. Inagaki et al teach (see col 5, lines 50-56) that the beta heat treating occurs in as short a time as possible because extended times at temperature causes an undesirable growth of the crystal grains. Therefore it would have been obvious to one of ordinary skill in the art to have reduced the amount of time at temperature to be 1-10 seconds as claimed in order to avoid any undesirable growth

of the crystal grains.

Regarding claim 29, Inagaki et al do not teach that the annealing occurs at 620°C for 4 hours. However, it would have been within the expected skill of a routineer in the art to have optimized the time and temperature of the heat treatment within the disclosed ranges in order to maximize the properties produced by the recrystallization. Time affects the total growth during recrystallization and temperature affects the growth rate during recrystallization. Changes in temperature, concentrations, or other process conditions of an old process do not impart patentability unless the recited ranges are critical, i.e., they produce a new and unexpected result. In re Aller et al (CCPA 1955) 220 F2d 454, 105 USPQ 233. Only result-effective variables can be optimized. In re Antonie 559 F2d 618, 195 USPQ 6 (CCPA 1977). See MPEP 2144.05 II.

Regarding claims 36-41, Kanno et al teach (see abstract and col. 1, lines 51-60) that the inner layer is zirconium metal (which acts as a barrier layer) and that ziracloy-2 has been used for the outer layer due to high corrosion resistance and small neutron absorption cross section.

4. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kanno et al (US 5,225,154) in view of Inagaki et al (US 4,810,461) as applied to claims 1-7 and 18-26 and 28-35 above, and further in view of Cheadle (US 4,065,328).

The teachings of Kanno et al in view of Inagaki et al are described above in paragraph no. 3.

Inagaki et al do not teach that the fast quenching occurs at 20-200°C/second.

Cheadle teaches (see abstract) a zirconium-based alloy, but also teaches (see col 1, lines 35-38) that fast quenching (more than 11°C/second) from the β-phase region causes the β-phase to transform into α-phase needles (i.e.-acicular or lath microstructure).

Therefore, it would have been obvious to one of ordinary skill in the art to have applied the fast quenching at a high rate as taught by Cheadle to the method of Inagaki et al in order to produce the lath α-microstructure as claimed.

Response to Arguments

5. Applicant's arguments filed 26 September 2003 have been fully considered but they are not persuasive. Applicant has argued that:

a. Inagaki does not teach an identical process;

b. There is no motivation to combine Inagaki with Kanno;

c. There is no expectation of success in combining Inagaki with Kanno; and,

d. There is no motivation to combine with Cheadle because Cheadle teaches a different base composition.

In response to Applicant's first argument, Inagaki et al teach (see col. 5, lines 7-68) that the method of treating the Zr alloy includes quenching from the β-phase temperature region (i.e.-above 980°C). While Inagaki et al are silent as to the exact speed of the quenching step, one of ordinary skill in the art would have looked to the other prior art to provide information on that step. Cheadle teaches (see col 1, lines 35-38) that fast quenching (more than 11°C/second) from the β-phase region causes the β-phase to transform into α-phase needles (i.e.-acicular or lath microstructure).

Andersson teaches (see col. 3, lines 48-57) that β-quenching occurs by heating the Zr alloy to a temperature in the β-phase region and then quenching at a high rate of speed such as 100-400°C/sec down to 700°C, and at at least 10°C/sec down to 300°C. Thus, one of ordinary skill in the art would have expected the quenching step of Inagaki et al to have the same quenching speed. Therefore, the quenching step of Inagaki et al occurs within the disclosed range.

In response to Applicant's second argument, the motivation to combine Inagaki et al with Kanno et al comes from the fact that the Zr alloy of Inagaki et al can provide the same strength and ductility properties required by Kanno et al while reducing the neutron absorption spectrum of the fuel cladding. The reduced neutron absorption spectrum would allow the cladding to perform better as a nuclear fuel rod covering by preventing loss of neutrons during the nuclear reaction.

In response to Applicant's third argument, Inagaki et al teach (see abstract) that the alloy is well suited to being used in a nuclear reactor. One of ordinary skill in the art would have expected, since all three layers are a majority Zr, that the alloy of Inagaki et al would have been able to be used. In fact, the layer of the alloy of Inagaki et al should match properties with the Zircaloy-2 outer cladding and the Zr inner cladding much better than the stainless steel or copper alloy. Since the substitution is merely swapping out a more similar alloy for a less similar alloy, one of ordinary skill in the art would have had a reasonable expectation of successfully applying the alloy of Inagaki et al as the middle layer of the cladding of Kanno et al.

In response to Applicant's fourth argument, while Cheadle has a slightly different

base composition (2.5-4.0 wt% Sn vs. 1-2 wt% Sn in Inagaki et al), one of ordinary skill in the art was well aware of the affects of β-quenching on low alloy Zr-Sn compositions. See also Andersson which teaches similar β-quenching for Zircaloy-2 and Zircaloy-4, both of which contain 1.2-1.7 wt% Sn. Therefore, one of ordinary skill in the art would have expected the β-quenching to have the same effect on the alloy of Inagaki et al, as it does on the alloys of Cheadle and Andersson. The combination is not made in hindsight, because, given the disclosure of Inagaki et al of "quenching", one of ordinary skill in the art would have looked to similar references to find out the exact parameters of the quenching, such as by looking to Cheadle.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D Wilkins, III whose telephone number is 703-305-9927. The examiner can normally be reached on M-Th 10:00am-8:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V King can be reached on 703-308-1146. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Harry D Wilkins, III
Examiner
Art Unit 1742

hdw

ROY KING
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700